Commentary: HIV/AIDS in the 1990s and beyond*

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The 1989 article by Chin & Mann on global surveillance and forecasting of acquired immunodeficiency syndrome (AIDS) made significant contributions to advocacy and programme design in the early days of a global response to HIV/AIDS.

Worldwide tracking and modelling of the epidemic is now coordinated by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and WHO, working together with networks of researchers and national programmes around the world. Sources of information on HIV/AIDS have improved significantly in many countries.

Today it is clear that, in contrast to the tentative forecast made by Chin & Mann that the cumulative number of AIDS cases would reach "2 to 3 million" by the mid-to-late 1990s, the epidemic is considerably more widespread and complex than foreseen. By the end of 1997, over 30 million people were estimated to be living with HIV/AIDS, and HIV continues to spread, with almost 16000 new infections each day. Since the beginning of the epidemic, 2.7 million children, 3.9 million women and 5.1 million men have died from AIDS — about the same number of individuals who have died from malaria over the same period.

The epidemic is concentrated in developing countries, with almost 90% of people infected with HIV living in sub-Saharan Africa and the developing countries of Asia. New HIV/AIDS epidemics, invisible or not yet begun in 1989, are now apparent in Eastern Europe and parts of Latin America. Meanwhile, AIDS cases and HIV infection rates in both North America and Western Europe are falling.

Armed with new data and methods of analysis, AIDS prevention programmes have increasingly focused on social environments, gender relations, human rights and socioeconomic inequalities as factors in the course of the epidemic. The example of Eastern Europe reminds us that an HIV epidemic can arise very quickly as an indirect consequence of drastic changes in socioeconomic conditions. Fortunately, although HIV infection rates are still rising rapidly in many parts of the world, there have also been some notable successes in slowing the spread of the virus in developing countries such as Senegal, Thailand, and Uganda.

Introduction

Back in 1988, as they wrote their article on global surveillance and forecasting of acquired immunodeficiency syndrome (AIDS), Jim Chin & Jonathan Mann were careful to list the unknowns that complicated efforts to estimate the scale and direction of the epidemic in the 1990s. Their forecast that the cumulative number of AIDS cases would reach "2 to 3 million" by the mid-to-late 1990s was a tentative one, fully cognisant of underreporting from many of the places where the epidemic was making its most serious inroads. Other daunting obstacles included insufficient information on reported cases and large gaps in both surveillance and behavioural data from many countries.

As we approach the end of the 1990s, three main points of contrast can be seen with the conditions and knowledge base of 10 years ago.

- First, the conditions: the threat to world health presented by HIV/AIDS is much more serious than foreseen. The epidemic is more widespread and considerably more complex, and has resulted in levels of mortality several times greater than those predicted. Close to 12 million people have already died of AIDS around the world, and three times as many are currently infected with human immunodeficiency virus (HIV), the virus that leads to AIDS. Unless an affordable cure is found, most of those infected with HIV will die within a decade.
- Second — and fortunately — understanding about what drives the epidemic and about what can be done to prevent it has developed greatly in the past 10 years. In some parts of the world, this understanding has been put into practice with encouraging results. In others, where the lessons

* Much of data in this article are taken from the recent WHO/UNAIDS Report on the Global HIV/AIDS epidemic, published in June 1998. The full report can be accessed on the Internet at http://www.unaids.org/highband/fact/index.html.

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have not been learned or lack of knowledge and resources have prevented application of this understanding, the epidemic has advanced unabated. Also, methods of data collection and modelling have improved vastly, not least because of increased political commitment and better technical cooperation between governments and international organizations.

- Third, while prevention remains the most effective response, the emergence of life-prolonging therapies is changing our vision and future estimates of the epidemic. The relationship between new infections, prevalence levels, incidence of AIDS and mortality are no longer as predictable as they were. However, due to the high cost of the drugs involved, it will be some time before significant effects are seen from these therapies in most developing countries, particularly those with the highest incidence of HIV infections.

Global HIV/AIDS estimates at the end of 1997

As of 31 December 1997, a total of 30.6 million people were estimated to be living with HIV/AIDS (Table 1). Since the beginning of the epidemic, deaths from AIDS have reached 2.7 million children under the age of 15 years, 3.9 million women, and 5.1 million men — about the same numbers as have died from malaria over the same period. The total number of AIDS orphans (children under 15 years of age when their mother or both parents died from AIDS) since the beginning of the epidemic is estimated at 8.2 million. In many places, AIDS is already the leading cause of death among adults aged 15–49 years. About 2.3 million people died of AIDS during 1997. Moreover, HIV continues to spread, with almost 16000 new infections each day — corresponding to about 5.8 million new infections in 1997 alone.

The impact of HIV on life expectancy is cancelling out many of the gains made over the last few decades in parts of the developing world. For example, life expectancy in Botswana rose from under 43 years in 1955 to 61 years in 1990. Now, with 25–30% of the adult population infected with HIV, life expectancy is expected to drop back to the levels seen in the late 1960s (Fig. 1). By the end of the decade, Zimbabwe will see 10 years wiped off the life expectancy of a child born in 1990.

Also threatened by AIDS are the great strides made by developing countries in increasing infant and child survival in recent decades. Today, 25% more infants under 12 months of age in Zimbabwe and Zambia are dying than would be the case if HIV was not present. By 2010, Zimbabwe's infant mortality rate is expected to increase by 138% because of AIDS, and its under-five mortality rate by 109%. In Côte d'Ivoire, child mortality will rise by over two-thirds.

Table 1: **Estimated number of adults and children living with HIV/AIDS, as of 31 December 1997**

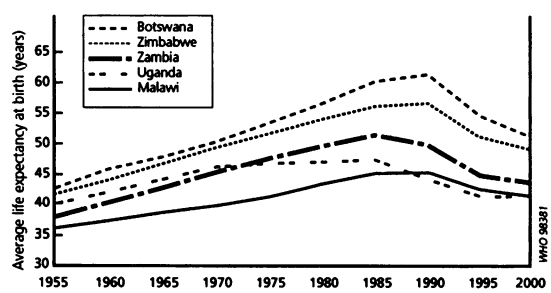
Region	No. of cases
Sub-Saharan Africa	21 000 000
South and South-East Asia	5 800 000
Latin America	1 300 000
North America	860 000
Western Europe	480 000
East Asia and Pacific (excluding Australia and New Zealand)	420 000
Caribbean	310 000
North Africa and Middle East	210 000
Eastern Europe and Central Asia	190 000
Australia and New Zealand	12 000

Global HIV/AIDS patterns

The past 10 years have seen important changes in the patterns of spread of HIV/AIDS. In some countries, HIV incidence has remained at roughly the same low levels for a number of years; in others, however, which currently have similar absolute levels of prevalence, a rapid spread of the virus is occurring.

In 1988, by far the greatest number of AIDS cases had been reported in North America, particularly among homosexual and bisexual men and among injecting drug users. Today, AIDS cases and HIV infection rates in both North America and

Fig. 1. **Projected changes in life expectancy in countries with high HIV prevalence.**



Western Europe are falling, with new infections being concentrated among injecting drug users. Antiretroviral drugs given to women during pregnancy and the availability of safe alternatives to breastfeeding have kept mother-to-child HIV transmission low.

HIV infections are concentrated in the developing world, mostly in countries least able to afford to care for infected people. Just under 90% of people infected with HIV live in sub-Saharan Africa and the developing countries of Asia, which between them account for less than 10% of global gross national product. In many parts of Asia, Eastern Europe, some Latin American countries and southern Africa, HIV infection rates are still rising rapidly; however, in some parts of Latin America, infection is falling or close to stable. This is also true in Uganda, one of the earliest countries to record epidemic growth in HIV infections; in Thailand, where the rapid spread of HIV has been checked by active prevention programmes; and in some West African countries. Nevertheless, although the situation is improving among many groups, large numbers of new HIV infections still occur every year in these countries.

Sub-Saharan Africa

The greatest numbers of HIV infections are currently concentrated in East and southern Africa. The Joint United Nations Programme on HIV/AIDS (UNAIDS) and WHO estimate that in at least two countries in southern Africa — Botswana and Zimbabwe — over 25% of all adults in the most sexually active age range of 15–49 years are already infected with HIV; an extremely rapid rise in HIV infection rates in other, more populous countries such as South Africa suggests that this pattern may be repeated there also. Africa also bears the brunt of infant infection and death. Infants can become infected with HIV in the womb, at birth, or through breastfeeding. In rich countries these modes of transmission have been eliminated almost entirely through the use of preventative drugs, caesarean section, and bottle-feeding. Fewer than 1000 infants were born with HIV in 1997 in the industrialized world, compared with over half a million in developing countries, mostly in Africa. None the less, some positive developments have been occurred in Africa. Uganda was the first African country to respond vigorously to a massive national HIV/AIDS burden, with strong efforts being made not only by government but by community and religious organizations. Results have been marked, particularly among younger age groups. For example, in 1991 about 38% of antenatal clinic attendees under the age of 20 years were HIV-positive; this rate declined to 7% in 1996. In another impressive example, early action by Senegal — including sexual health education, widespread treatment for sexually transmitted diseases (STDs), and widespread condom promotion — has kept HIV prevalence consistently low. While the HIV infection rose rapidly in some other urban sites in West Africa, in the Senegalese capital, Dakar, the infection rate appears to have stayed below 2%.

Asia and the Pacific

The fact that Chin & Mann's article had little to say about Asia is indicative of how fast HIV/AIDS conditions can change. Today, about 6.4 million people are believed to be living with HIV infection in Asia and the Pacific — just over one-fifth of the world's total. By the end of the year 2000, that proportion is expected to grow to one-quarter. Around 94 000 children in Asia now live with HIV infection. Countries such as Myanmar and Thailand in South-east Asia have been hit comparatively hard, as has India. Although <1% of the total adult population in India is infected with HIV, this amounts to about 4 million people, making it the country with the largest number of HIV-infected people in the world. While the prevalence of HIV infections remains low in China, an increasing number of cases are being recorded there. Rates of HIV infection remain low in Bangladesh, Indonesia, Lao People's Democratic Republic, Pakistan, Philippines, and Sri Lanka. Why this is so when other countries in the region show much higher levels of infection is not entirely clear. Moreover, there is no assurance that the prevalence of HIV infection will remain low in these countries, given the widespread occurrence of risk behaviours including commercial sex, drug injecting (in some places), and the recent economic crisis, which may make millions of adults and children more vulnerable to HIV infection.

Here, also success stories and determined efforts can be found. In close collaboration with UNAIDS, the World Bank and bilateral programmes, India is now on the verge of expanding its numerous small-scale, successful intervention projects to countrywide coverage. Similarly, in Thailand there has been a reduction of risk behaviours on a national scale and a decline in HIV prevalence among certain key populations. Among sex workers in Bangkok, for example, HIV prevalence declined from 13% in 1994 to about 7% in 1996.

Latin America and the Caribbean

Some 1.3 million people are believed to be living with HIV/AIDS in Latin America and the Caribbean. The pattern of HIV spread in Latin America is

much the same as that in industrialized countries. Men who have unprotected sex with other men and injecting drug users who share needles and syringes are the focal points of HIV infection in many countries in the region. Increasing rates among women nevertheless show that heterosexual transmission is becoming more prominent. A quarter of the 550000 adults currently living with HIV infection in Brazil are women and in the region as a whole, the proportion is around one-fifth. HIV infection has reached levels of 1% among pregnant women in Honduras and more than 3% in Porto Alegre, Brazil. Rates are substantially higher in the Caribbean.

Industrialized countries

Industrialized countries that have invested heavily in prevention programmes — especially among young heterosexuals, homosexual communities, and injecting drug users — have been rewarded with falling numbers of new HIV infections. Expensive drug therapy is staving off both AIDS and death among people infected with HIV in these countries, although it is not yet clear how long these therapies can remain effective.

Also, it must be noted that these improvements are not uniform throughout a given society. Among Americans of African origin, for example, new AIDS cases rose by 19% among heterosexual men and 12% among heterosexual women in 1996; and for the Hispanic community in the USA there were 13% more cases among men and 5% more among women in 1996 than a year previously.

Eastern Europe

Few parts of the world have seen greater political and social change over the last 10 years than Eastern Europe, and such change applies also to the HIV/AIDS situation. Until the mid-1990s, most of the countries of Eastern Europe appeared to have been spared the worst of the HIV epidemic. By the end of 1997, however, some 190000 adults in the region were living with HIV/AIDS. Since 1994, Belarus, Moldova, the Russian Federation and Ukraine have all registered marked growth in HIV infection rates.

The bulk of the spread has been among injecting drug users, accounting for four of every five newly diagnosed infections. Furthermore, the true number of infections is greatly underported. For example, in the Russian Federation it has been estimated that there are six people living with HIV infection for every one person who has tested HIV-positive. In some areas of Eastern Europe, there seems to be a strong overlap between injecting drug users and sex workers. The observed rise in new cases of STDs may reflect a dramatic increase in unprotected sex, a breakdown of STD treatment services, or both.

North Africa and the Middle East

Less is known about HIV infection rates in North Africa or the Middle East than in other parts of the world. Just over 200000 people are estimated to be living with HIV/AIDS in these countries, under 1% of the world total. While the generally conservative social and political attitudes in the Middle East and North Africa often make it difficult for governments to address risk behaviour directly, such behaviour does exist. At least one country in the region has started a programme to reduce risky drug-injecting practices and in several places community and non-governmental organizations have been able to help sex workers and others to protect themselves from HIV infection.

Beyond numbers — improved understanding

Analyses that draw universal conclusions about relationships seen at the global level may be useful in pointing to general factors — such as education, economic growth or equality between men and women — which greatly influence the spread of HIV. But global analyses may mask the important differences between regions, countries or communities that are at the core of this diverse epidemic.

Why, then, are some countries and communities worse affected by HIV than others? The answers are complex and still being explored, analysed and debated.

For example, HIV is far more easily passed on to or from a partner who is suffering from another STD such as syphilis or genital ulcer disease. High levels of STDs in communities where their treatment is poor, unavailable, or unaffordable lead to high HIV infection rates.

One area of investigation is the extent to which risk behaviours practised among populations can differ from one country to another. Studies indicate that the type of sexual partner and patterns of sexual mixing that are common in a community provide part of the explanation. For instance, in countries where commercial sex is very common HIV spreads faster than in countries where casual sex more commonly takes place through a diffuse network of noncommercial partners. Adolescent girls are at greater biological risk of HIV infection than older women, so communities where very young women

are sexually active often have high levels of HIV infection.

The social, economic, and cultural situations that create this kind of vulnerability to HIV infection have not been adequately studied or explained. Although many countries — notably those in sub-Saharan Africa — have set up surveillance systems to track the spread of HIV through their populations, far fewer have collected any information on the sexual and drug-taking behaviours that are central to the spread of HIV. Since these behaviours precede infection with the virus, information about them can act as an early warning system and indicate how exposed a community may be to HIV. When such information is collected over time, it can also indicate trends in risk behaviour, validate existing prevention approaches or suggest what changes need to be made for greater impact. And of course, better behavioural surveillance makes its greatest contribution when it is used in conjunction with better monitoring of the spread of HIV itself.

In the past few years, AIDS prevention programmes and related research have increasingly focused on the issue of vulnerability to HIV/AIDS — that is, on social environments, gender relations, human rights and socioeconomic inequalities as factors either enabling risk behaviours or facilitating control of an individual's actions in avoiding such behaviours. There has also been an increased recognition that societies and cultures are dynamic, not frozen in time, and that epidemics respond to these changes. The example of Eastern Europe reminds us that an HIV epidemic can suddenly appear as an indirect consequence of drastic changes in socioeconomic conditions. And looking towards the future, increased international migration linked with economic globalization may be an important factor in the spread of HIV over next few years.

Data collection and modelling

Worldwide tracking and modelling of the epidemic are now coordinated by UNAIDS and WHO, working together with networks of AIDS researchers and national AIDS programmes around the world. Through their efforts, sources of information on HIV infection and AIDS have improved significantly in many countries. Many of the problems listed by Chin & Mann related to making projections of future cases have been solved or greatly reduced. At the same time, new knowledge inevitable brings new questions and new nuances to data interpretation.

Improved data sources for modelling

Previous HIV/AIDS estimates relied heavily on data collected from specific groups judged to be at high risk of infection — sex workers, truck drivers who buy sex or injecting drug users, for instance — and therefore provided only a sketchy idea of what was happening in much of the population. Sentinel surveillance systems provided a better guide to trends in the general population, but the information thus obtained was usually available only for cities, and gave no picture of infection in the rural areas (where the bulk of the population lives in many developing countries). Modelling had to be done on a regional basis, with epidemic curves fitted according to the patterns observed in countries with relatively good surveillance systems. Today, improved data collection has made it possible to build models not on a regional basis (as was done during the last major estimate of the global prevalence of HIV, in 1994–95) but for some 90 individual countries. Also, more is known about the natural history of HIV infection, so that better assumptions can be made to fill gaps left by missing data. Serosurveys, mostly in rural areas, have provided better indications of the likely relationship between urban and rural HIV infection patterns. Data are also available for more points in time, making it easier to gauge the shape of a country's HIV/AIDS epidemic (i.e Is prevalence just starting to build up, at the steeply rising phase, or beginning to level off?). Benefits from improvements in data gathering, estimation and projection of the epidemic are provided by the example of Thailand. In the early 1990s, Thailand's national HIV/AIDS estimate and projection contributed significantly to the increase in government budget and multisectoral commitment, and thus to the success of the national AIDS programme.

Regional differences in progression rates

One of the important unknowns 10 years ago was the annual rate of progression from HIV infection to the development of AIDS and subsequent death. There are still important gaps in understanding this issue, but recent research suggests that progression rates differ between industrialized and developing countries. This improved understanding contributed to the modelling that produced the 1997 estimates shown in Table 1. For example, in areas with relatively well-developed health systems such as Latin America and the wealthier countries of Asia, 50% of infected adults are assumed to live with HIV for 10 years before developing AIDS. This figure was derived largely from studies in industrialized countries before the advent of combination antiretroviral

therapy. The median time between development of AIDS and death is assumed to be 1 year. In poorer countries where access to health services is less developed, the median time between being infected with HIV and the onset of symptomatic AIDS is assumed to be 8 years, with the same distribution around the median as in the better-off countries. The survival time between onset of AIDS and death is identical, a median of 1 year.

Mother-to-child HIV transmission rates

Levels of transmission of HIV from mother to child also vary according to region. This can result from different breastfeeding norms, delivery practices, and other factors related to maternal care and health service provision.

Rates of HIV transmission from mother to child can now be estimated on the basis of studies in various countries. In Africa and other areas where HIV status is rarely known and breastfeeding is the overwhelming norm, a vertical transmission rate of 35% was used. Based on Brazilian studies, a rate of 25% was used for Latin America, where access to testing and counselling is increasing and where safe alternatives to breastfeeding are available, at least in urban areas. Rates in Asia vary between these two values, depending on the structure of the health system, access to information, and breastfeeding patterns.

Life-prolonging therapies and HIV/AIDS forecasting

The advent of life-prolonging therapies will significantly alter future HIV/AIDS estimates. The relationship between new infections, HIV prevalence, AIDS and deaths — relatively predictable for some years now — will change in ways that cannot yet be foretold. And these changes will depend on the extent and availability of health care in a population, including better treatment for opportunistic infections. It is also far from certain what effect combination antiretroviral therapy will have on patterns of infection. Reduced viral load among patients taking these drugs may reduce their infectiousness to others. However — and this is a current concern — the promise of prolonged life for those infected may undermine prevention efforts and result in more risky behaviour and more transmission.

Whatever the effects of treatment, they are likely to be much greater in industrialized countries, where antiretrovirals and drugs for opportunistic infections are widely available. It will be some time before significant effects of treatment are seen at a population level in most developing countries, where the vast majority of people do not even have access to the counselling and testing facilities that allow them to determine whether they are infected and should seek care. Rates of transmission from mother to child may fall radically if there is increased access to testing and counselling, short-course antiretrovirals, and safe alternatives to breastfeeding. Finally, although not yet visible on the short-term horizon, the development of effective vaccines will also have significant effects on future estimates and modelling of HIV/AIDS.

Conclusion

Ten years on from when it was published, the article by Chin & Mann stands as clear example of the cardinal importance of estimating and projecting. Even with imperfect methods and limited data (which is still the case today, however many advances have been made), the numbers and analysis it provided made significant contributions to advocacy and programme design in the early days of a global response to HIV/AIDS. Like the work of a decade ago, the 1997 HIV/AIDS estimates produced by UNAIDS and WHO do not provide an exact count of infections. Rather, they are designed to give a good indication of the magnitude of the epidemic, both regionally (as was done by Chin & Mann) and in individual countries. Moreover, they are constantly being revised, both upwards and downwards, as countries improve their surveillance systems and collect more information. Estimates will also change as our understanding of HIV and its demographic consequences grows — as it certainly will continue to do.

Résumé

Commentaire: Le VIH/SIDA dans les années 90 et au-delà

L'article de Chin & Mann de 1989 sur la surveillance mondiale et les prévisions concernant le syndrome de l'immunodéficience acquise (SIDA) a apporté une contribution importante aux efforts de sensibilisation et de conception des programmes dans les premiers temps de la riposte mondiale au VIH/SIDA. La surveillance mondiale et la modélisation de l'épidémie sont désormais coordonnées par le Programme commun des Nations Unies sur le VIH/SIDA (ONUSIDA) et l'OMS, qui collaborent avec des réseaux de chercheurs et avec les programmes nationaux du monde entier. Les sources d'information concernant le VIH et le

SIDA se sont considérablement améliorées dans de nombreux pays. Il est clair aujourd'hui que, contrairement aux prévisions avancées par Chin & Mann selon lesquelles le nombre cumulé de cas de SIDA atteindrait "2 à 3 millions" au milieu ou à la fin des années 90, l'épidémie est considérablement plus étendue et plus complexe que prévu. Fin 1997, on estimait que plus de 30 millions de personnes vivaient avec le VIH/SIDA, et le VIH continue de se propager au rythme de quelque 16000 nouvelles infections par jour. Depuis le début de l'épidémie, 2,7 millions d'enfants, 3,9 millions de femmes et 5,1 millions d'hommes sont morts du SIDA — soit à peu près le même nombre de personnes mortes du paludisme pendant la même période.

L'épidémie est concentrée dans les pays en développement, pratiquement 90% des personnes infectées par le VIH vivant en Afrique subsaharienne et dans les pays en développement d'Asie. De nouvelles épidémies dues au VIH/SIDA, encore invisibles ou inexistantes en 1989, ont fait leur apparition en Europe orientale et dans certaines parties d'Amérique latine. Par contre, les cas de SIDA et les taux d'infection par le VIH en Amérique du Nord et en Europe occidentale sont en diminution.

Armés de nouvelles données et de nouvelles méthodes d'analyse, les programmes de prévention du SIDA se sont de plus en plus concentrés sur le milieu social, les relations entre les sexes, les droits de l'homme et les inégalités socio-économiques, considérés comme des facteurs contribuant à l'épidémie. L'exemple de l'Europe orientale nous rappelle qu'une épidémie de VIH peut se produire très rapidement comme conséquence indirecte des bouleversements profonds de la situation socio-économique. Heureusement, même si les taux d'infection par le VIH augmentent encore rapidement dans de nombreuses parties du monde, on a également enregistré des succès notables en parvenant à ralentir la propagation du virus dans des pays en développement comme le Sénégal, la Thaïlande ou l'Ouganda.